

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD

STRUCTURE FOR WATER CONTROL

(No.)  
CODE 587



**DEFINITION**

A structure in an irrigation, drainage, or other water management system that conveys water, controls the direction or rate of flow, or maintains a desired water surface elevation.

**PURPOSE**

This practice may be applied as a part of a conservation management system to support one or more of the following purposes:

- To control the stage, discharge, distribution, or direction of water in open channels or water use areas.
- To provide for water quality control.
- To protect fish and wildlife and other natural resources.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies wherever a permanent structure is needed as an integral part of an irrigation, drainage, or other water-control

system to serve one or more of the following functions:

1. To convey water from one elevation to a lower elevation within, to, or from a ditch, channel, or canal. Typical structures: drops, chutes, turnouts, surface water inlets, head gates, pump boxes, and stilling basins.
2. To control the elevation of water in drainage or irrigation ditches. Typical structure: flashboard risers.
3. To control the division or measurement of irrigation water. Typical structures: division boxes and water measurement devices.
4. To keep trash, debris, or weed seeds from entering pipelines. Typical structure: debris screens.
5. To control the direction of channel flow resulting from tides and high water or backflow from flooding. Typical structure: tide and drainage gates.
6. To control the level of a water table or to remove surface or subsurface water from adjoining land, to flood land for frost protection or to manage water levels for wildlife or recreation. Typical structures: water level control structures, pipe drop inlets, and box inlets.
7. To provide water control for recreation or similar purposes.
8. To convey water over, under, or along a ditch, canal, road, railroad, or other barriers. Typical structures: bridges, culverts, flumes, inverted siphons.
9. To modify water flow to provide habitat for fish, wildlife, and other aquatic animals.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

Typical structures: deflectors, chutes, cold water release, or structures to make pools and riffles.

## CRITERIA

### General Criteria Applicable to All Purposes

All planned work shall comply with all federal, state, and local laws and regulations. Plans for water control structures may need to be permitted by the appropriate Water Management District (WMD) and comply with the appropriate WMD rules contained in Chapter 40-4 Florida Administrative Code (F.A.C.), Environmental Resource Permits: Surface Water Management Systems; Chapter 40-40 F.A.C., Standard General Environmental Resource Permits: Regulation of Stormwater Management Systems; Chapter 40-41 F.A.C., Environmental Resource Permits: Surface Water Management Basin Criteria; Chapter 40-42 F.A.C., Environmental Resource Permits: Regulation of Stormwater Management Systems; Chapter 40-44 F.A.C., Environmental Resource Permits: Regulation of Agricultural Surface Water Management Systems.

Water control structures shall be designed and constructed in conformance with provisions contained in Part 650, Engineering Field Handbook for Conservation Practices, Chapter 6 - Structures, Chapter 14 - Drainage, and Chapter 15 - Irrigation. Detailed information and criteria about water control structures are contained in the National Engineering Handbook Part 623 - Irrigation, Chapter 3; and Part 624 - Drainage, Chapter 6 and Chapter 10. Structures shall be designed on an individual job basis to meet site conditions and functional requirements. They shall be part of an approved engineering plan for irrigation, drainage, wildlife, recreation, channel improvement, or similar purposes.

Structures must not create unstable conditions upstream or downstream. Water control structures installed in an open channel shall be designed to discharge the channel design flow at the designed channel hydraulic gradeline. Additional capacity needed under flood conditions shall be provided by "island" type installation. Provisions must be made for safe reentry of bypassed flow as necessary.

Where conduits are used, the diameter shall be based on design capacity but shall not be less than 6 inches in diameter. The length of the

pipe shall be determined by the width and side slopes of the required embankment or roadway over the pipe and shall extend a minimum of two feet beyond the toe of the designed fill except where headwalls are used.

Flashboard Riser and Culvert Structures. These structures will be designed according to the hydraulic conditions under which they will function. Each condition will require a different design.

When this type structure is used for water stage control in a drainage ditch or irrigation canal and the flashboards will be removed to provide design discharge capacity, the pipe may be designed as a culvert with a riser width equal to or greater than the culvert diameter. If the boards are to remain in place during the design discharge, the structure will be designed to pass the design discharge with all the boards in place and will be designed as a drop inlet.

When used for reservoir or lake level control, this structure shall be designed as a drop inlet.

Structures used to protect grade shall meet the requirements of NRCS conservation practice standard Grade Stabilization Structure, Code 410. The portion of the flashboard riser opening below grade of the upstream channel bottom will be permanently closed with a headwall of steel across the bottom of the semi-circular riser.

**Earth embankment.** The minimum top width for an embankment shall be 6 feet. If the embankment top is to be used as a public road, the minimum width shall be 16 feet for one-way traffic and 26 feet for two-way traffic. Guardrails or other safety measures shall be used where necessary and shall meet the requirements of the responsible road authority.

Freeboard. The minimum elevation of the top of the settled embankment shall be 1 foot above the design water surface or natural ground, whichever is higher.

Side slopes. The combined side slopes of the settled embankment shall be not less than 5 horizontal to 1 vertical (5:1), and neither slope shall be steeper than 2 horizontal to 1 vertical (2:1). All slopes must be designed to be stable. Where embankments are to be mowed or used by the public for recreation; 3 horizontal to 1 vertical (3:1) or flatter slopes are recommended.

Compaction. The embankment fill material shall be compacted in accordance with the specified design requirements for compaction

and moisture content. Maximum thickness of earthfill layers will be 9 inches. If for any reason the designer is of the opinion that more stringent compaction requirements are necessary, percent of standard proctor and moisture limits may be specified. The design height of the embankment shall be increased by the amount needed to ensure that after settlement has taken place, the constructed height of embankment will equal or exceed the design height. This settlement shall not be less than 3 percent for rubber tired pans and scrapers and 5 percent for track type equipment such as bulldozers, except where detailed soil testing and laboratory analysis shows a lesser amount is adequate or field observations indicate a greater amount is needed to obtain the required level of compaction.

**Materials.** Structures installed under this standard shall be constructed of durable material with a life expectancy equal to the planned life of the structure.

Pipe conduits used shall meet the requirements as stated in NRCS Florida conservation practice standard for Pond, Code 378.

Polyethylene, Type III, Class C, Category 4 or 5 conforming to ASTM and D 3350 and AASHTO M 252 or M 294, Type S, may be used for water control structures with a hydraulic head of 10 feet or less. Pipe connections must be water tight.

Concrete appurtenances used shall be designed for the anticipated loading and shall meet the requirements of National Engineering Handbook, Part 642, Specifications for Construction Contracting, Structure Concrete.

**Seepage control.** Seepage control is to be included if (1) seepage will create unstable conditions downstream, (2) it is needed to ensure a stable embankment or (3) special circumstances require drainage for a stable structure. Seepage may be controlled by foundation, abutment or embankment drains.

Seepage along pipes extending through the embankment may be controlled by use of a filter and drainage diaphragm, unless it is determined that antiseep collars will adequately serve the purpose. Anti-seep collars and drainage diaphragms shall meet the requirements of NRCS Florida conservation practice standard for Pond, Code 378.

**Antivortex devices.** Closed conduit spillways designed for pressure flow must have adequate antivortex devices. Antivortex devices shall be designed in accordance with ARS-NC-33, Hydraulics of Closed Conduit Spillways, Part XIV.

**Trash guard.** Where necessary to prevent clogging of the conduit, an appropriate trash guard shall be installed at the inlet or riser. The trash guard shall be designed and constructed in such a manner that flow to the inlet will not be adversely affected.

**Protection.** A protective cover of vegetation shall be established on all disturbed earth surfaces. Where necessary, temporary vegetation will be used until permanent vegetation can be established. Vegetative measures including seedbed preparation, seeding, fertilizing, and mulching shall comply with NRCS conservation practice standard Critical Area Planting, Code 342.

Where needed to protect the outlet from erosion, it shall be protected with riprap or other means.

## CONSIDERATIONS

Structures located in areas used for livestock or in urban areas should be fenced as necessary to control access and exclude traffic to prevent damage to the structure from vandalism, as well as preventing serious injury to trespassers.

Where conditions preclude or make it difficult to establish vegetative cover, consider using non-vegetative coverings such as gravel, geoweb, gabions, interlocking blocks or other type of protection.

Water control structures with detention storage may affect the volume and rates of runoff, evaporation, deep percolation and ground water recharge.

Water control structures may trap sediment and sediment attached substances carried by runoff. Consideration should be given to the amount of sediment that will be deposited and allowances made for removal.

In highly visible public areas and those associated with recreation, careful considerations should be given to landscape resources. Landforms, structural materials, water elements, and plant materials should visually and functionally complement their surroundings. Excavated material and cut

slopes should be shaped to blend with the natural topography. Shorelines can be shaped and islands created to add visual interest and valuable wildlife habitat. Exposed concrete surfaces may be formed to add texture or finished to reduce reflection and to alter color contrast. Site selection can be used to reduce adverse impacts or create desirable focal points.

Where structures are used in irrigation or drainage of crops, consideration should be given to the structure's effect on the water table to ensure that a suitable rooting depth for the crop will be maintained.

Structures for water control can increase the application efficiency of subirrigation systems.

If watercourse fisheries are important, special precautions or design features may be needed to ensure continuation of fish migrations.

Structures for water control may have short term construction-related effects on the quality of downstream water.

## PLANS AND SPECIFICATIONS

Plans and specifications for installing structures for water control shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. The plan shall specify the location, grades, dimensions, materials, and hydraulic and structural requirements for the individual structure.

## OPERATION AND MAINTENANCE

Operation and maintenance shall be in accordance with the requirements of this standard and in keeping in conformance with all local, state, and Federal laws and regulations. Structures for water control must be adequately maintained if their purposes are to be realized through the expected life. Special considerations shall be given for maintenance needs during the planning, design, and construction of the structure. An operation and maintenance plan shall be prepared for each structure site and provided to the landuser. The water control structure should be inspected periodically to ensure that the structure functions as planned.

Vegetation on all earthfills shall be inspected regularly. Mow when vegetative growth becomes excessive. Damaged vegetation shall

be replaced in accordance with NRCS FL conservation practice standard Critical Area Planting, Code 342.

Structures shall be inspected for deterioration and capacity. Any blockage of trash and debris that could affect flows through the structure shall be removed. Materials that have deteriorated, including rock used for outlet protection shall be replaced.

The structure shall be inspected for safety of people or animals using the area near the structure.

Periodically remove sediment that accumulates during the design life.

## REFERENCES

- AASHTO M 252 and M 294
- ARS-NC-33, Hydraulics of Closed Conduit Spillways, Part XIV.
- ASTM D 3350
- WMD Chapters 40-4, 40-40, 40-41, 40-42, 40-44 F.A.C.
- Florida Department of Transportation, Specifications for Road and Bridge Design
- National Engineering Field Handbook, Part 650
- Chapter 6, Structures
- Chapter 14, Drainage
- Chapter 15, Irrigation
- National Engineering Handbook
- Part 623, Irrigation
- Part 624, Drainage
- Part 642, Specifications for Construction Contracting, Structure Concrete
- NRCS Florida Conservation Practice Standards:
- Critical Area Planting, Code 342
- Grade Stabilization Structure, Code 410
- Pond, Code 378